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# **Can China's Growth be Sustained?**

## **A Productivity Perspective\***

**JINGHAI ZHENG<sup>1</sup> and ARNE BIGSTEN**

Department of Economics  
School of Business, Economics and Law  
Göteborg University, Sweden

**ANGANG HU**

Center for China Studies  
School of Public Policy and Management  
Tsinghua University, Beijing, China

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### **Summary**

China's unorthodox approach to economic transition has resulted in sustained high growth. However, in recent years Chinese economists have increasingly referred to the growth pattern as "extensive", generated mainly through the expansion of inputs. Our investigation of the Chinese economy during the reform period finds that reform measures often resulted in one-time level effects on TFP. China now needs to adjust its reform program towards sustained increases in productivity. Market and ownership reforms, and open door policies have improved the situation under which Chinese firms operate, but further institutional reforms are required to consolidate China's move to a modern market economy.

**JEL-classification:** O47, O53, D24

**Keywords:** Growth, Productivity, China

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<sup>1</sup> Corresponding Author: Jinghai Zheng, Department of Economics, Göteborg University, Box 640, S-405 30 Göteborg, Sweden; E-mail: [Jinghai.Zheng@economics.gu.se](mailto:Jinghai.Zheng@economics.gu.se). Jinghai Zheng is also Guest Research Fellow at the Center for China Studies, Tsinghua University, Beijing, China.

## 1. Introduction

China has achieved tremendous economic progress in the last three decades. Since the economic reform process started in 1978, Chinese per capita income has increased eightfold. But the piecemeal and gradual reform strategy pursued by China means that the market still has not permeated the entire economy. Property rights and related institutions are far from the ideal textbook model. However, as in the East Asian NICs, key ingredients of China's reform strategy have been education, high savings, and export orientation. A controversial aspect of the present strategy is also the attempt to preserve an undervalued currency to promote export.

While China's unorthodox approach to economic transition has been successful in promoting rapid economic growth, in recent years economists have been increasingly concerned about the pattern of "extensive" growth, a term often used to describe Soviet growth during the Cold War period.<sup>2</sup> Its main characteristic is growth generated mostly through the expansion of inputs and only marginally through increased productivity (Ofer, 1987). From the late 1970s to the early 1990s, China's growth depended more on productivity growth and less on increased capital than other East Asian NICs at a comparable stage of their development. However, since then growth in capital inputs has exceeded GDP growth, often substantially. Some recent studies have reported a prolonged slowdown in total factor productivity growth (Zheng and Hu, 2006; OECD 2005).

This situation might have been due to the fact that China's productivity growth before the mid-1990s was driven mainly through one-time dramatic improvements in policies. But changes in policies may temporarily affect a country's growth rate by affecting the level of TFP without affecting its growth rate in the long run. China is a fast grower not because its institutions are among the best, but because it has improved its institutions so much in the last two decades. If it does not reform further, its per capita income growth might slow down (Klenow, 2001).

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<sup>2</sup> "Extensive growth" – a term widely used among Chinese economists, as well as by the media and even in official documents – is a hotly debated issue.

There are two major aspects of China's recent economic development that have been particularly worrisome. At the macro level the growth has been mainly investment-driven, creating a series of imbalances in the economy. Stabilization measures have been taken to prevent rapid economic growth from becoming overheated. At the micro level, the financial performance of many firms is poor, with low efficiency and lack of technological innovations. There is an expanding literature trying to explain this pattern of development, discussing whether extensive growth is sustainable and what China's future development strategy should be. In this paper, we approach the issue of sustainability regarding China's growth through a productivity perspective, which is something touched upon in several studies but yet to be fully explored (Garnaut, 2005).

Although conventional wisdom has emphasized saving and investment as central in the theory of economic development (Lewis, 1954), a growing body of research suggests that, even after physical and human capital accumulation are accounted for, total factor productivity (TFP) accounts for the bulk of cross-country differences in the level and growth rate of GDP per capita (Easterly and Levine, 2001). Several studies have pointed out that differences in physical and intangible capital cannot account for the large income differences across countries today. Savings-rate differences are of limited importance. What is most important is TFP, and a theory of TFP growth is needed to understand the large international income differences (Prescott, 1998). More effort towards modeling and quantifying TFP is required (Easterly and Levine, 2001), and TFP should be the focus of growth research (Klenow, 2001).<sup>3</sup>

In the next section we characterize China's growth pattern by decomposing growth into factor accumulation and TFP growth, and we review the literature on Chinese

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<sup>3</sup> There is also another reason that we are interested in linking TFP growth with the currently overheating Chinese economy. TFP is not only important for long run growth, but also for shorter-period concerns. Simulation studies of business cycles of both industrialized and less developed countries indicate that TFP is very important for understanding period of depression and prosperity. Examples are Japan's lost decade of growth in the 1990s (Hayashi and Prescott, 2002), Argentina's great depression in the 1980s (Kydland and Zarazaga, 2002), and Ireland's booms and busts during the four decades up to 1990s (Ahearne, Kydland, and Wynne, 2005). China could be another interesting case for business cycle studies from a productivity perspective.

TFP growth. In Section 3 we then examine the process in which capital is accumulated, and analyze the determinants of China's high rate of accumulation. In Section 4 we assess whether capital is allocated and utilized efficiently. In Section 5, we summarize what we have learned about the decline in TFP growth from a productivity perspective and comment on policy challenges in improving the allocation of factors and the efficiency of their utilization. Section 6 concludes.

## **2. China's Growth Pattern Since 1978**

China has experienced three major waves of reform since 1978. The first was the reform of collective farming with the household-responsibility system and the upward price adjustment for some agricultural products, which resulted in a rapid increase in agricultural productivity and output for several years (Wen, 1993).<sup>4</sup> The second wave started in the middle of the 1980s and continued into the early 1990s, during which managers and workers in state owned enterprises were gradually provided with greater incentives to improve efficiency. Township-village enterprises flourished, achieving higher technical efficiency levels than state firms (Zheng, Liu, and Bigsten, 1998), and helping shift much of the rural labor-force to industries (Goodhart and Xu, 1996). The third wave started with Deng Xiaoping's tour of Southern China in 1992. Many state and collective firms were privatized, foreign direct investment poured in, and exports accelerated.

A noteworthy feature of China's growth during 1978-1995 was its reliance on productivity growth. Relative to other rapidly growing Asian economies at a comparable stage of development, China's growth during this period was less dependent on growth of capital and labor (World Bank, 1997). In most East Asian countries, growth of capital exceeded GDP growth, often substantially, but not in China where GDP grew faster than capital, suggesting that factors other than capital accumulation were important determinants of GDP growth during the early reform years (Table 1 and Figure 1).

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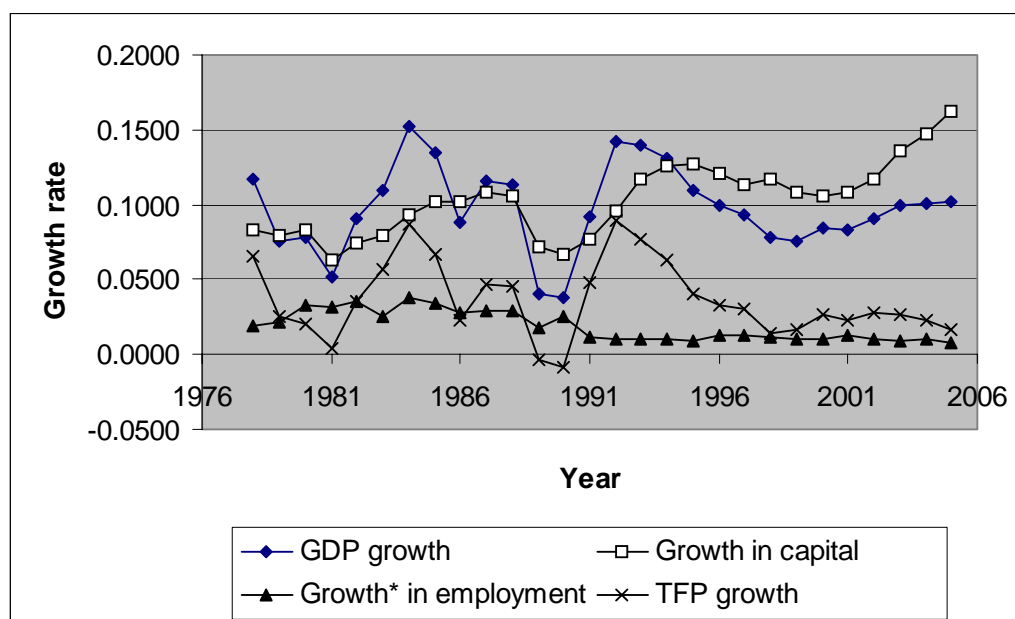
<sup>4</sup> New results at both regional and national levels suggest that factor productivity showed a sharp increase in the early 1980s, entered a period of stagnation or flux in the late 1980s followed by another period of productivity growth and slowdown in the 1990s (Mead, 2003). Fan and Zhang (2002) found that the official data overstated the impact of rural reforms on both production and productivity, but both production and productivity still grew at respectable rates during the reform period (See also Xu, 1999).

**Table 1. China: Growth accounting 1978-93 and 1993-2005**

	1978-93		1993-2005	
	pct per year		pct per year	
Average growth				
GDP	9.90		9.91	
Factors				
Capital	8.76		12.34	
Labor	2.51		1.06	
TFP <sup>0.6</sup>	3.64		2.08	
TFP <sup>0.5</sup>	4.27		3.21	
TFP <sup>0.4</sup>	4.89		4.34	
		Share of total		Share of total
Contribution to GDP growth				
Total GDP	9.90		9.91	
Factors	5.64	0.58	6.7	0.69
Capital	4.38	0.45	6.17	0.64
Labor	1.26	0.13	0.53	0.05
TFP <sup>0.5</sup>	4.27	0.44	3.21	0.33

*Note:* TFP<sup>0.6</sup> refers to the estimates using 0.6 as capital share, and so on so forth.

*Sources:* NBS, and author estimates



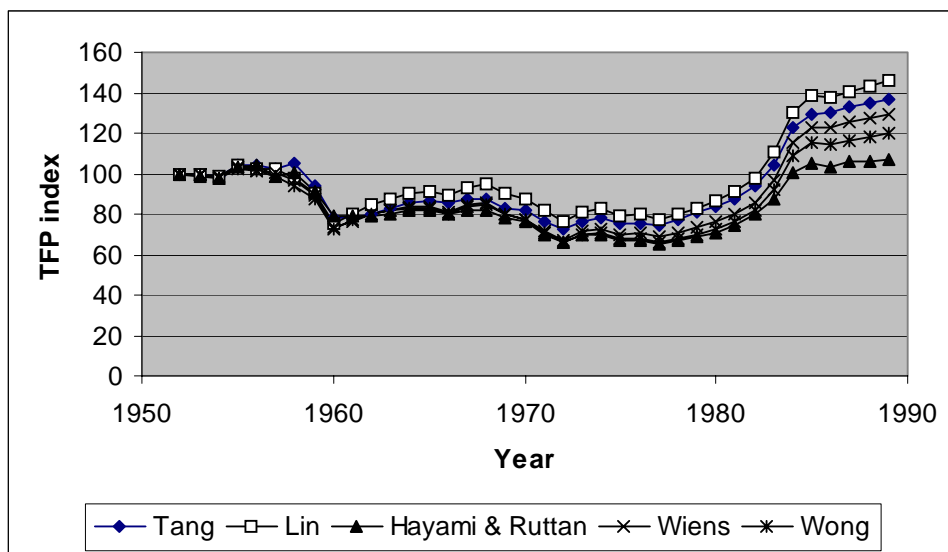
**Figure 1 Growth in input, output, and TFP (1978-2004)<sup>5</sup>**

<sup>5</sup> Recently revised GDP statistics are used. See Appendix for a description of data.

Empirical studies estimate that TFP growth accounted for 30-58% of China's growth during 1978-95 (World Bank, 1997; Maddison, 1998). Hu and Khan (1997) found that an average TFP growth of 3.9% explained more than 40% of China's growth during the early reform period. However, Krugman (1994) pointed out that it is difficult to account for China's growth because the quality of the numbers is poor. Young (2003) also questioned Chinese growth during the economic reform period, by focusing on the nonagricultural productivity. After adjusting official data, he found growth comparable to that previously experienced by other rapidly growing economies. After accounting for growth of labor (largely due to increased labor force participation), the shift of labor out of agriculture, and rising educational levels, he found nonagricultural labor productivity growth at 2.6% and TFP growth at 1.4% per year.

Although estimates of China's productivity growth during the reform period differ, several factors behind it can be identified. First, the success of the rural reform from the late 1970s to the early 1980s resulted in a temporary surge in TFP in agriculture (Figure 2). Second, industrial reforms provided individual firms, managers, and workers with greater incentives to improve efficiency, and especially township-village enterprises (TVEs) achieved higher efficiency levels and TFP growth than state firms (e.g. Zheng, Liu, and Bigsten, 1998; Goodhart and Xu, 1996). Table 2 compares TFP growth in state and rural industries (TVEs). Third, rising labor force participation rates, improvements in educational attainment, the transfer of labor out of agriculture, and the narrowing the technology gaps between China and developed economies also contributed to the TFP growth. However, some of these factors only had a one-time level effect on TFP. Agriculture productivity growth slowed significantly from around 1983 and industrial productivity even recorded a decline during 1993-96 (Table 3). So future TFP growth may not match the levels witnessed in the past (Maddison 1998, Liu 2000, Heytens and Zebregs 2003), unless further reforms are undertaken.

As some economists predicted, while TFP growth was satisfactory up to the early 1990s, reports of productivity slowdown started to emerge around the year 2000. Jefferson et al. (2000) investigated industrial productivity during 1980-96 finding long-term productivity growth but at declining rates during the 1990s. Zhang (2002) also found a downward trend for the aggregate economy during 1993-98, noting that



**Figure 2** TFP indexes from different studies (*Source: Wen, 1993*)

**Table 2. Comparison of growth and efficiency in SOE and TVE sectors (1979-91)**

Growth rate	In national industry	In SOE industry	In TVE
Output	13.33	8.4	25.3
Capital	-	7.8	16.5
Labor	-	3.0	11.9
TFP	-	4.0	12

*Source:* Reproduced from Goodhart and Xu (1996).

**Table 3. Annual growth of aggregate industrial TFP**

Period	TFP growth	Period	TFP growth
1980-1996	2.83	1992-1996	1.50
1980-1984	2.49	1988-1993	3.80
1984-1988	4.66	1993-1996	-0.77
1988-1992	2.68	1992-1993	8.29

*Source:* Reproduced from Jefferson et al. (2000).

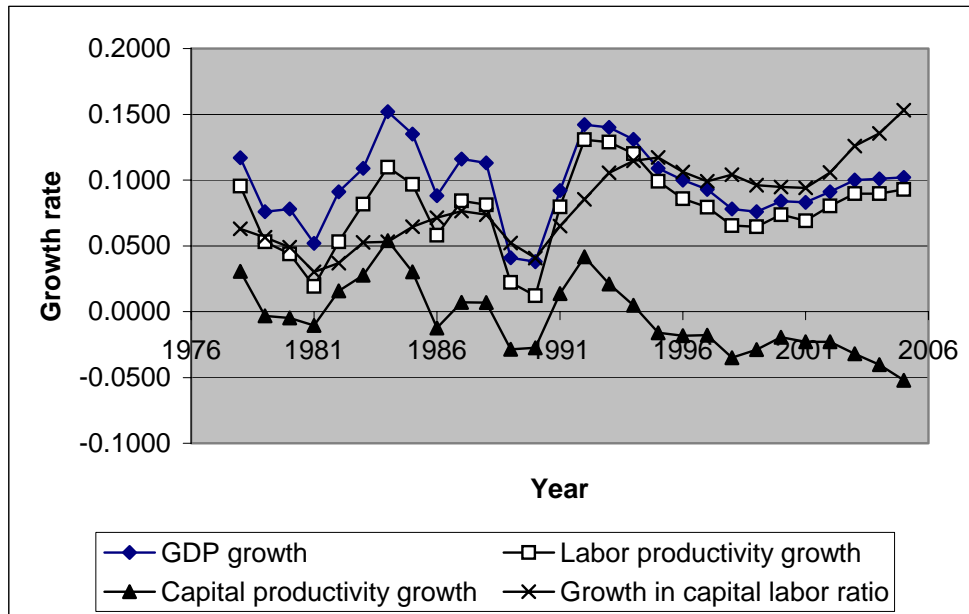


it had become increasingly difficult to maintain GDP growth for a given increase in investment. Zheng and Hu (2006) found that TFP growth fell dramatically during 1995-2001, accounting for as low as only 7.8% of GDP growth. Whereas TFP had risen by 3.2-4.5% per year before 1995, it rose only 0.6-2.8% per year after that. The OECD (2005) estimated that annual TFP growth averaged 3.7% during 1978-2003, but slowing to 2.8% by the end of that period (Economist, 2005). This was due to a decline in the growth rate of total factor productivity from 1993.

**Table 4. Growth in factor productivity and capital labor ratios**

	1978-93	1993-2004
GDP growth	9.88	9.91
growth in capital stock	8.76	12.34
Growth in capital productivity	1.01	-2.15
growth in employment	2.51	1.06
Growth in labor productivity	7.19	8.76
growth in capital-labor ratio	6.10	11.17

Source: NBS, and author estimates.



**Figure 3 GDP Growth, growth in ratios (1978-2005)**

The overall decline in TFP growth is clearly seen if one divides the period 1978-2005 into two sub periods 1978-93 and 1993-2005 as in Kuijs (2006). Average growth of capital exceeded growth of GDP by 2.43% in the second period (Table 1 and Figure 1). The relative contribution of TFP growth to GDP growth also declined, so that growth was largely driven by growth of capital, growing at the amazing rate of 12.34% per year. This increased the capital/labor ratio very fast (Table 4 and Figure 3), which in turn led to an increase in labor productivity. The increase was relatively modest because the effect of capital deepening was counterbalanced by the slowdown of TFP growth.

Explanations for changes in TFP growth are often controversial, but the slowdown since 1993 coincides with sluggish rural income growth and widespread industrial inefficiency. Human capital, land, and other resources are misallocated, underemployed, and inefficiently used (OECD, 2002). The growth has increasingly relied on capital accumulation, while growth of labor has declined (Table 1 and Figure 1).

In spite of all these problems the economy has not shown any signs of slowing down. Instead the government has had to use a combination of economic and administrative measures in 2004-2006 to cool off the investment boom (Krueger, 2005). To understand how extensive growth emerged in China and whether growth can be sustained, we need to analyze factor accumulation, factor allocation, and TFP growth. We start by discussing capital accumulation.

### **3. Capital Accumulation**

Relative to Western economies China still has a low capital/labor ratio. Labor is abundant, but human capital measured as the average level of education is still low. Thus, investment in both physical and human capital is important for growth. But in this section we discuss the results of excessive capital accumulation since 1990 and the policy supporting it. In the next section we will discuss how capital has been allocated and utilized and its impact on TFP.

After a recession in 1989-90, China's leadership signaled its long-term commitment to market-based reforms, and investment accelerated reaching 43.5% of GDP in 1993. Investment then slowed due to the bursting of a real estate bubble and retrenchment policies aimed at controlling the surging inflation in 1995-96. Consumption and exports were also becoming increasingly important, though the Asian financial crisis of 1997-99 temporarily slowed China's growth. Investment surged again beginning in 2000 through a combination of massive government infrastructure spending and both foreign and domestic investment in manufacturing. Preparations for the 2008 Olympic Games contributed further to the frenzy of construction projects. China's 2002 accession to the WTO also spurred foreign and domestic investment in China in anticipation of greater market opportunities. As investment in factories and other construction as well as roads and other infrastructure reached unprecedented levels, gross capital formation rose from 36% in 2000 to 43% in 2003 — about 5 percentage points above China's 1978-2003 average (Shane and Gale, 2004). All this investment meant that GDP grew by over 9% per year from 1995.

Two aspects of central government policy since the mid-to-late 1990s supported this extraordinary investment growth. First, key input prices such as land, electricity, and other utilities, including water, were kept low through subsidies and controlled pricing. In many cases land was allocated for development at zero cost, and electricity for foreign direct investment was sold at half price. Second, cheap finance was channeled into industry, particularly to SOEs and other large companies, often effectively at zero cost. This was made possible by the high savings rate, which averaged 40% of GDP for most of the 1990s and has recently grown to close to 50% (IMF, 2005). The investment boom was also fueled by local governments, over which the central government had limited control following fiscal decentralization in 1994 (Lin and Liu, 2000; OECD, 2002. p. 57). They constructed plants and infrastructure even if it made little economic sense.

Besides high growth, China's investment strategy has had three side-effects. First, the buildup of excess capacity led to deflation (Lin, 2004). At the macroeconomic level, investment in inventories has been negative since the second half of 1999, signaling excessive production capacity (Zhang, 2006). By 2004, 90% of manufactured goods were in oversupply. In the automobile and steel sectors there was evidence that excess

capacity was beginning to drive prices down (China Business Review, 2005). This could reduce profits and result in a new accumulation of non-performing loans in the banking system, reversing some of the progress that has been achieved there in recent years (Prasad, 2005).<sup>6</sup>

A second effect of high (and excessive) investment in industries is the official turn towards export markets, which partly explains the growing effort of Chinese businesses in recent years to go global. Globalization is increasingly viewed as an alternative to “domestic structural complexity” (Project Syndicate, 2005). But China’s exports in part rely on what may be an unsustainably low fixed exchange rate. China gradually depreciated the currency from 3 yuan per dollar in 1985 to 5.76 in 1994, when it was depreciated to 8.62. Between 1997 and 2005 China maintained its exchange rate at approximately 8.28, a rate that some economists suggest is much too high. Under pressure from abroad, particularly the USA, the currency has been appreciated to currently about 7.8 yuan per dollar.

A further side effect of high investment is thus a huge trade surplus, especially with the US. China’s stock of foreign reserves has risen sharply since 2001, and is currently the world’s largest at close to 900 billion dollars. China is thus facing an excessive growth of credit and money supply, which is fueling another real estate bubble in the major cities.

A vicious circle seems to have developed. The high investment rate has built up excess capacity, which has caused deflationary pressure on manufactured goods, cutting profit margins, and accumulating non-performing loans in the banking system. At the same time, using exports to absorb excess capacity has resulted in a large buildup of foreign reserves and rapid increase in the money supply, which in turn is fueling another round of excessive lending and investment, generating more excess capacity.

While the production system has thus far been generating excess capacity on its own, radical reform in education, health, and pensions systems have been contributing to

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<sup>6</sup> The Standard & Poor's rating agency currently estimates that China's banks have issued about \$650 billion in bad loans, or about 40 percent of outstanding loans (Wolf, 2005).

the problems. A high domestic savings rate has made it possible for China to invest on such a large scale. An important reason for the high savings is that the transition from planned to market economy has involved a massive shift of financial risk from state-owned enterprises to households, thereby creating a large perceived need for precautionary savings by households to fund anticipated educational, medical, and retirement expenses (Kroeber, 2005). But household savings, while high, do not alone explain the nations' high savings-rate. As corporations have improved their performance, their savings have risen and now account for almost half of national savings. Corporations have an incentive to retain their earnings in order to self-finance their investments (Dunaway and Prasad, 2006). High public savings, also contribute (IMF, 2005).

The government has not been willing or able to enforce strict environmental regulations, so excessive investment in manufacturing also led to misuse of the country's natural resources, including energy, and to degradation of the environment. About 70% of the country's rivers and lakes are seriously polluted, and WHO reports that two-thirds of Chinese cities have air quality below standard, of which nine are in the world's top ten of the most polluted, especially with high carbon monoxide. The government estimates that about 400,000 people die each year of diseases related to air pollution (Hunt 2006).

The export strategy requires easy access to ports and, given China's labor abundance, concentration on low value-added, low technology, non-branded goods. The benefits of growth have thus not been shared evenly across regions, skill levels, or industrial sectors, creating increasing gaps between rich and poor. The newly rich have achieved an economic standard vastly different from that of the poor (Gilboy and Heginbotham, 2004). Chinese policy-makers are at present pushing the notion of "harmonious development", which suggests that measures to spread the benefits of growth more equitably are under consideration.

#### **4. Allocation and Utilization of Capital**

About two-thirds of China's investment has been in construction of infrastructure such as roads, dams, public buildings, and other facilities. Most of the remainder is in

machinery and equipment (Shane and Gale, 2004), mostly manufacturing; agriculture, which produces 15% of GDP, is getting only 2% of investment.

The state sector, although contributing only one-third of China's GDP, still controls much of the country's capital (Wu, 2000). For example, most “private” investments are made by state-owned or collectively owned enterprises, funded by internally generated funds or loans from state-owned banks. During 1993-2000 more than 60% of all loans went to state-owned enterprises (Wolf, 2005). Foreign investment has increased, but still accounts for only about 5% of total investment (Shane and Gale, 2004).

There are signs of too much investment in manufacturing for export (Blanchard and Giavazzi, 2005), so that investments on the margin have low returns. In the 1980s and 1990s it took \$2-3 of new investment to produce \$1 of additional growth, now it needs more than \$4 (Zhang, 2006). None of the high performing East Asia NICs such as South Korea, Taiwan, and Japan, had such high incremental capital/output ratios at comparable stages in their development. India, often compared unfavorably with China, is more efficient in this regard (Economist, March 2004).

State-owned enterprises are also a major source of inefficiency (OECD 2005). Their poor economic performance can be traced in part to the accumulation of policy burdens arising from their long-standing use to accomplish social-policy goals, but their performance is often mediocre and their flexibility constrained by government intervention in their management (OECD, 2002). Poor management and inefficient operations have led to low profits and high debt, which has prompted government intervention, thus spreading the problem by extracting resources from stronger enterprises to prop up those that are failing; large SOEs receive preferential treatment from the government and are often sheltered from competition. There is a large spread between the minority of state companies that earn respectable returns and the majority that barely breakeven. The median SOE was earning a rate of return of only 1.5% in 2003, hardly any change from 1998; almost two-thirds of SOEs failed to earn a return of 5% (OECD, 2005).

Another source of misallocation has been government interventions in economic activities and coincident corruption. The growth-promoting policy initiated by the central government has been interpreted at the local level as growth at any cost. Achievement projects and image-projects have run rampant as local governments competed for a nominal share of increased GDP (China Daily, 2004). There has then emerged what Hunt (2006) calls China's trilogy of local company, local government, and local bank. Each has a vested interest in building whatever plant was in vogue, whether a steel mill, power station, air-conditioner factory, copper-tube plant, whatever. Very often these plants have been financed with zero-cost capital, with corrupted officials benefiting financially in the process.

A source of both misallocation and underutilization is the fragmentation of Chinese markets because of local protectionism. In contrast to the formerly centrally-planned economies of Eastern Europe, China's production facilities are sub-optimal in both scale and scope, resulting in wasteful duplication. For example, there are 200 producers of automobiles, most of which make only a few thousand units per year, and there are nearly 8,000 cement firms compared to 110 in the United States, 51 in Russia, 58 in Brazil, and 106 in India (OECD, 2002).

According to Gilboy (2004), the political perils of challenging competitors and their local patrons account for this fragmentation. Few Chinese firms develop alliances with or invest in companies in other provinces. One recent survey of 800 companies that have conducted domestic mergers and acquisitions found that 86% invested in firms within their own city, 91% within their own province. Strong local political ties thus tend to isolate a region from the rest of the economy.

A recent study for the State Council (China's cabinet) revealed that Chinese managers regard the country's two most politically powerful technological and industrial hubs, Beijing and Shanghai, as leading centers of local protectionism. Among the industries most affected by such protectionism were pharmaceuticals, electrical machinery, electronics goods, and transport equipment. Private firms suffered the most, foreign-funded firms the least, which suggests that the burden of domestic protectionism falls most heavily on Chinese firms (Gilboy, 2004).

The scale of FDI has been large, amounting to 6% of GDP in the early 1990s, falling back to 3.5% since 2000 – though the absolute amount increased (China Business Review, 2005). Slightly more than one-quarter of this inflow is actually retained earnings, though this has been declining. It is difficult to be precise about the geographic origin of FDI, but official figures show that almost half comes from Hong Kong, China or tax havens, and about one-third comes from other Asian countries (OECD, 2005). A significant part presumably originates in third, unidentified, countries. This can even include Chinese capital that has been recycled in order to benefit from the advantageous tax treatment offered to foreign-based companies.

But Huang (2005) shows that any favoritism shown towards FDI at the expense of domestic investors pales in the face of favoritism shown towards SOEs. The real issue is not domestic vs. foreign investment, he argues, but a reluctance to support the growth of the domestic private sector. Better to welcome FDI than allow the growth of an indigenous entrepreneurial class that might challenge the political status quo. In effect, FDI has acted as a way to delay political reform.

Most sources of China's FDI are small and medium-sized foreign companies, and investors of this size often bring relatively little technology, organizational know-how. Econometric estimates suggest that their overall productivity is actually slightly lower than that of privately controlled domestic companies (OECD, 2005). So the role of foreign-controlled companies in raising productivity should not be overstated.

A major current government policy concern is that China has not invested in long-term technological research like Japan, South Korea, and Taiwan did during the 1970s and 1980s. According to Gilboy (2004), Chinese firms tend to import technology by purchasing foreign manufacturing equipment, often in complete sets such as assembly lines. Throughout the 1980s and 1990s, such hardware accounted for more than 80% of China's technology imports, whereas licensing accounted for only 9%, "know-how" services 5%, and consulting 3%. Over the last decade, large- and medium-sized Chinese industrial firms have spent less than 10% of the total cost of imported equipment on indigenizing technology. Such spending by SOEs even in the sectors in which China is most often cited as a rising power is also low (telecom equipment 8%,



electronics 6%, and industrial machinery 2%). This is much lower than the average for industrial firms in OECD countries (about 33%).<sup>7</sup>

## 5. Policy Lessons

After reviewing China's recent growth performance, there are a few lessons that might be learned from a productivity perspective. In the late 1990s, Chinese planners were preoccupied with maintaining growth of 8% in the face of the East Asia financial crisis, but the role of TFP growth was not clearly understood. Some forecasts rely on high capital formation, but if growth of capital exceeds GDP growth, one ends up with "extensive growth". For example, with a capital elasticity of 0.6 and TFP growing of 3% per year, China would be able to sustain a growth of 7% if capital formation of 30% of GDP were maintained (Chow and Li, 2002). If the capital stock grew at a rate of 8% together with growth in output and labor force at 2%, growth in GDP would be almost exhausted by input-growth with capital's contribution being 6.4% and labor's contribution 0.8%. TFP would only need to grow at 0.8%, a rather minor issue.

If one instead assumes a smaller output-elasticity of capital, say 0.5, TFP becomes more important. If the labor force grows slightly above 1% as it has in the last decade, one needs a TFP growth of 3.6% to achieve 8% GDP growth. Chinese planners have been overly optimistic (Table 3), with forecasts of TFP's contribution to output-growth (made in the year 2000) estimated at 54% to 60% for the 10th and 11th five-year plans (Song and Li, 1999-2000). Researchers at the State Planning Committee also assumed TFP-growth increasing from 3% to 4.5-5% in forecasting economic growth from 2001 to 2015 (Research Group, 2000). Although forecasts of TFP's contribution to output-growth after the 10th five year plan ended were adjusted downward to less than 30%, researchers at the Development Research Center of the State Council predicted that TFP growth brought about by urbanization, investment in

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<sup>7</sup> The practice of Chinese firms also stands in contrast to spending patterns in Asian countries such as South Korea and Japan in the 1970s and 1980s, when they were trying to catch up with the West. Industrial firms in those countries spent between two and three times the purchase price of foreign equipment on absorbing and indigenizing the technology embodied in the hardware (Gilboy, 2004).

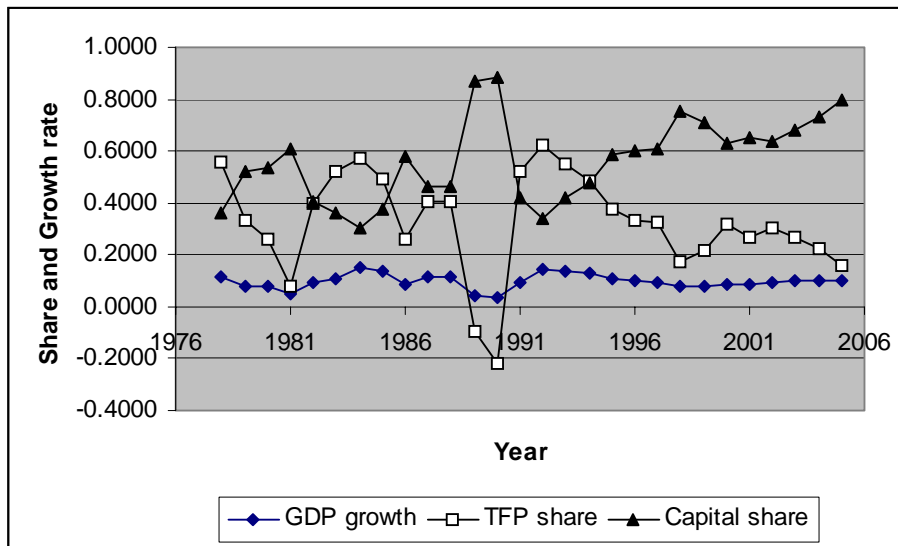
human capital, economic reform and technological innovation would make an increasing contribution to economic growth (People's Daily, 2005).<sup>8</sup>

**Table 5.** Growth Accounting: contributions to GDP growth (1979-2015, %)

Period	Capital	Labor	TFP
1979-1997	37*	16*	47*
2000-2005	32*	12*	56*
	37	10	53
2006-2010	32*	10*	58*
	37	9	54
2010-2015	32*	8*	60*
	37	7	56

Note: TFP forecast after 1998, GDP growth was given at 7%. Estimates with \* indicate that cost share of capital was used as weight, while estimates without used accumulation rate as weight.

Source: Research Center, Ministry of Science and Technology, cited in Song and Li (1999-2000).



**Figure 4** Counterbalancing business cycles in China

It is not clear whether in recent years investment has been used by the government as a last resort to counterbalance business cycles when TFP growth did not deliver as

<sup>8</sup> It's still not very clear how the assumption of increasing TFP's contributions to growth found its way entering these forecasts, while recent economic studies rather predict either slowdown in TFP growth or reported unsatisfactory performance by Chinese firms in technology absorption and innovation.

expected. During 1978-1993 period, the TFP share of GDP growth was basically procyclical, while during 1993-2005 the reverse seems to have occurred by the end of the period (Figure 4). Growth was clearly driven by an increasing share of capital stock, while the TFP share decreased. Perhaps it is fair to say, had there been a deeper understanding of the forces behind TFP growth, economic reform policies could have been better designed in several respects. Some of these are related to rather standard results in the growth and productivity literature.

### **5.1. Structural economic reforms**

It has often been taken for granted that economic reforms aiming at establishing a market system with private ownership will automatically boost efficient production and promote technological progress including innovations. But the important thing in this context is to understand that the establishment of market, ownership reform, foreign direct investment, and trade will only improve the situation under which Chinese firms operate to a certain extent.

Policy miscalculations may also arise in health care, education, and housing. One school of thought on the interpretation of Chinese reform is that China has achieved the greatest success in precisely the areas where market reforms have gone the furthest (Sachs and Woo, 2000). However, this may not apply in certain areas. For example, the transition from planned to market economy has involved a massive shift of financial risk from state-owned enterprises to households, thereby creating a large perceived need for precautionary saving by households to fund anticipated retirement, medical and educational expenses. High saving has become a major source of imbalance in the macro economy.

*Level effects vs. growth effects:* Economists often point out that the most important component of China's growth is the immense productivity gain arising from the shift of labor from low-productivity agriculture to higher-productivity services and industry (e.g., Kroeber, 2005). While this type of policies has been successful in promoting growth and productivity for a sustained period, the limitations of such policies were not properly understood among policy analysts. Some policies that aimed at alleviating past distortions from the planning period had only one time level

effect. For example, when the TVEs development, which transferred more than 120 million people out of agriculture, had been exhausted in the early 1990s. Although the reallocation of labor from low-productivity to high-productivity activities would continue to contribute to economic growth, a recent reversal in the policy of promoting urbanization was signaled by the government's call for the construction of the new socialist countryside, indicating an intended slowdown in the urbanization process in the near future.

*Technical progress vs. efficiency improvement:* Change in TFP can be decomposed into technical progress and efficiency change; the former is associated with changes in the best-practice production frontier, and the latter with other productivity changes, such as learning by doing, improved managerial practices, and changes in the efficiency with which a known technology is applied. Identifying TFP growth with technical progress ignores the importance of technical efficiency-change, especially in less-developed countries. Introducing new technologies there without first realizing the full potential of existing ones might be wasteful (Felipe, 1999). Several studies have found that TFP growth in China has been achieved more through technical progress than efficiency improvement (Zheng, Liu, and Bigsten 2003; Zheng and Hu, 2006). Since efficiency remains low, there are still large unexplored possibilities for efficiency-improvement in China.

*Education:* A typical Chinese planner would think education is good for growth and productivity; it is hard to believe that sustained productivity improvements can be achieved without an educated population. But the rapid growth of China's universities since 1999 has resulted in lower teaching standards and reduced quality. In 1999, when the government launched a higher education expansion program, and universities enrolled 1.59 million students, up 48 percent from the previous year. Though the expansion has enabled more people to enter the college, they still face out-dated teaching methods, insufficient funding and a surplus number of graduates scrambling for jobs. The lack of funding haunts many higher education institutions such that an average 2,000 yuan (250 US dollars) is available for each undergraduate nowadays compared with 6,000 yuan prior to the expansion. Perhaps this explains why Holz (2005) found a negative relationship between education and output using Chinese aggregate time series data.

## 5.2. External policies

As in the East Asian NICs, one of the key ingredients of China's reform strategy has been export orientation. The policy has led to rapid expansion of the output of labor-intensive and low value-added production, seems to be consistent with China's comparative advantages. More than 60% of industrial exports from foreign-invested enterprise, a substantial fraction of the remainder of the country's exports consists of industrial products that are either OEM (original equipment manufacturer) manufactures, or low value-added, low technology, non-branded goods for global giant firms (e.g. garments, footwear, furniture, toys). Chinese firms spend negligible amounts on research and development. While the world's giant firms are rapidly building their research and development bases in China, employing relatively cheap, highly skilled Chinese researchers, not a single indigenous Chinese firm is in the world's top 700 firms by research and development expenditure. China does not have a single one of the world's top 100 brands. Its leading firms are almost unknown outside the country. Among the 14 Chinese firms in the Fortune 500, none has become a truly globally competitive company that could compete without government protection. All of these firms are state-owned and subject to systematic state interference in their operation (Nolan, 2005).

Still, Rodrik (2006) notes that China's export is more technology intensive than one would assume given its factor endowments. He argues, however, that the country has via its industrial policy managed to shift its export structure in this direction. The government has been willing to support investments that are more sophisticated than what its comparative advantages would typically support and what the market left to itself would generate. And he argues that once one successful firm can be established in a new type of production it tends to be followed by others. Once investors in a country "discover" a number of high-productivity exportable, this has a powerful demonstration effect. Such an investment strategy may have static inefficiency costs, but he argues that it is an essential force behind the rapid Chinese growth. This proposition has not been properly investigated yet, but this is something that needs to be looked into in greater detail.

China currently seems to attempt to preserve an undervalued currency as an export promotion measure. One would assume that an undervalued exchange rate reduces the pressure for technical upgrading of production structures. However, Guillaumont Jeanneney and Hua (2003) get mixed results. They find that appreciation of the reach exchange rate in China has had an unfavorable effect on technical progress, but a favorable effect on efficiency growth, and that these two effects partially offset each other to give a small negative effect on productivity growth. More efforts are needed to further investigate the issue.

### **5.3. Stabilization policy**

A series of imbalances in the macro economy have to be dealt with if China is to raise TFP growth. There have been many discussions about what policy adjustments are currently needed. Blanchard and Giavazzi (2005) recommend a three-handed strategy. This entails a decrease in saving (particularly private saving), an increase in the supply of services (particularly health services), and an appreciation of the RMB. Dunaway and Prasad (2006) point out that this discussion runs the risk, however, of prompting a string of ad hoc policy actions that could provide temporary relief, but no lasting solution to fundamental imbalances in the Chinese economy. They argue instead that the real issue in China is how to rebalance the economy away from heavy dependence on exports to lead growth towards domestic demand, including a substantial improvement in the efficiency of investment. They note that, as companies have improved their performance, corporate saving has risen and now accounts for almost half of national saving. Corporations have an incentive to retain their earnings in order to self-finance their investment. This is particularly true for private sector companies, which have limited access to bank financing and few domestic alternatives for raising money. State-owned enterprises that do make profits are generally not required to pay dividends to the government, and these companies naturally prefer to retain their earnings and plow them back into new investments. By some measures, Chinese households have in recent years saved almost a third of their disposable income. The precautionary motive for saving is very strong among Chinese households. Demographic factors add to this saving motive.

It makes sense for China to encourage greater consumption, but this can only happen slowly since the incentives for precautionary saving are high; and corporate saving is not intermediated. The slow development of financial markets in China has meant limited availability of credit, so that households generally have to save in order to purchase big-ticket items. Since there are few alternatives to saving in state-owned banks, it has also meant limited opportunities for portfolio diversification and low returns on households' financial assets. Financial market reform and development is thus a key priority, which the Chinese authorities recognize (Dunaway and Prasad, 2006).

#### **5.4. Environmental constraints**

One may expect that TFP grows fast when the economy grows rapidly. However, both estimates of GDP and TFP growth would be lower if environmental costs were taken into account. For example, policies, which encourage mining, may do little to promote development, when account is taken of the environmental degradation and resource depletion (Stiglitz, 2001).

The Chinese government has been working on criteria and indexes of a green GDP, which deducts the cost of environmental damage and resources consumption from the traditional gross domestic product (People's Daily, March 12, 2004). Preliminary results in the recently issued Green GDP Accounting Study Report 2004 suggests that economic losses due to environmental pollution reach 512 billion yuan, corresponding to 3.05% of GDP in 2004, while imputed treatment cost is 287 billion yuan, corresponding to 1.80% of GDP (GOV, 2006). Although the concept of and measurement for green GDP are rather controversial, the report may serve as a wakeup call to the government's strategy of growth at all costs.

From a productivity analysis perspective, the concept of green GDP can be straightforwardly extended to TFP, i.e., green TFP. A slower green TFP growth may imply a slower (green) GDP growth.

## 6. Concluding Remarks

China has had one unorthodox reform after another with short-run gains in productivity. Structural reforms with longer-run effects have been delayed in the process. China's growth-strategy since the mid-1990s has emphasized capital formation at the expense of efficient allocation and utilization of production factors, which has led to a slowdown in TFP growth.

Ironically China's recent capital-intensive growth resembles the Soviet Union's, which China has tried to avoid during its nearly thirty years of economic reform and opening up to the outside world. The Soviet Union only managed GNP growth of 4-5% per year (Perkins, 1988), while China's GDP has been 8-9% and its economy is much more open. To many international commentators China looks more like the East Asian tigers.<sup>9</sup> But in fact both the Soviet Union and the East Asian NICs applied the model of unlimited labor-supply (Lewis, 1954), since both emphasized saving and investment strongly (Sachs, 2004).

To achieve continued high GDP growth China will in the longer term have to rely more on TFP growth and less on capital deepening than in recent years. According to the recently released 11th Five-Year Plan, the government recognizes that future economic growth will depend on science and technological innovation, which in turn depend on government policies towards research and development including entrepreneurial activity, and the establishment of market-based institutions.

Prasad and Rajan (2006) argue that China's current stage of development, along with its rising market orientation and increasing integration with the world economy, may make the incremental and piecemeal approaches to reforms increasingly untenable and, in some cases, could even generate risks of their own. The present favorable domestic and external circumstances provide a window of opportunity for bolder reforms and for tackling some deep-rooted problems without causing much economic disruption.

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<sup>9</sup> We saw above that China's TFP growth slowed since the mid-1990s, but over the whole reform-period it has been rising at 2-3% per year, actually faster than the East Asian tigers at the same stage of development; during 1960-84 their TFP growth averaged only 1% (Economist, May, 2004). This may be explained by the fact that China has had access to a more advanced stock of world knowledge available at modest cost to enhance production.



Non-market institutional development is also required to complete China's move to a market economy with sustained productivity growth. Igniting economic growth generally requires a limited range of reforms that need not overly tax non-market institutions. But sustaining it is in many ways harder (Rodrik, 2003). Conventional development strategy emphasized the importance of increasing capital and reducing economic distortions. But further economic development also requires a more fundamental transformation of society, including a change in "preferences" and attitudes, acceptance of change itself and abandonment of many traditional ways of thinking (Collier and Gunning, 1999). So many economic and social problems remain to be addressed if China is to achieve the transformation from extensive to intensive growth that is necessary to sustain growth in the long run.

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## **Appendix**

### **Data Description**

The main variables investigated in the study are aggregate output (GDP at constant price), aggregate labor (number of people employed), and capital stock (accumulated fixed capital investment at constant price). Although the purpose of our work was basically to update the data for a few years, each of the variables involved some complications. China's GDP estimates have been criticized by several authors, but we chose to use the official figures from the recently updated nominal GDP and GDP series for 1993-2005. This represented an increase by 16% of the 2004 GDP over the old statistic. The major problem with the labor force series was a huge jump in the 1990 figure, which registered a 17% increase in the labor force in comparison with 1989. Capital stock was the most problematic, but we basically followed Kuijs (2006), who based his estimates on Wang and Yao (2003).

### **GDP**

The most recent study on China's reform period economic growth figures is Holz (2006), who discards Maddison's 1998 OECD study<sup>10</sup> in favor of the official data. Data problems were also discussed in Holz (2004) with special attention to GDP data as the aggregate measure of productive activities in China. We noted the arguments of Holz (2006 and 2004) and used the official statistics for the aggregate measure of output. GDP figures from 1977 to 1992 were taken from Wang and Yao (2003), while the recently revised GDP figures were used for 1993 to 2005.

### **Labor**

A major change in the registry in 1990 and subsequent layoff of state workers made the employment statistics before and after 1990 inconsistent. This problem was not present in Table D.3., Maddison (1998), but he notes, "The 1997 Yearbook give a total for the years 1990 onwards which is bigger than the sum of the sectors, and differs from the total in previous yearbooks. There seems to be some sort of error in

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<sup>10</sup> Maddison's adjusted GDP growth figures gives an average annual real GDP growth rate of 7.49 percent between 1978 and 1995, which contrasts the official statistics of 9.88 percent.



the new official total.” (p.172, cited in Holz, 2006). Holz took the matter more seriously, he reported that the Statistical Yearbook 1997 and in all later editions, the NBS retrospective revised total employment of 1990 upward by 14.12 percent, and similarly for later years, without, however, attributing this increase in employment to individual industrial sectors (agriculture, industry, construction, etc). However, with the Yearbook 2005 (CSY, 2005), which we use, the increase in the employment from 1990 was also distributed to the different sectors.

While the labor force of society is no longer reported as the official aggregate employment series, these data continue to be collected and can be inferred from the detailed tabulations of the CSY. Young used these data to extend the “old” series to 1998, as reported in table 5 of his study. However, he was not able to avoid a further discontinuity, introduced in 1998, when the definition of workers in urban enterprises was revised to include only those actually working and receiving income (as opposed to those who retained employment contracts, without actually working in the unit). This resulted in a substantial reduction in the estimated working population, particularly in manufacturing.

In our study, we used an old series for employment of 1990-1995 in World Bank (1997, Table 30), so the growth rate in employment in 1990 was taken from this old data series for time plot and estimate of TFP by year.

### **Capital stock**

For the 1977-1999 period, we used capital stock data taken from Wang and Yao (2003). To update to 2005, total fixed asset investment figures came from Statistical Yearbook 2005 for 2000-2004 period (CSY, 2005). 2005 statistics on total social fixed asset investment and price index were from the Abstract of China Statistics 2006. The depreciation rate is 5% as in Wang and Yao (2003).